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Food & Nutrition Research Briefs

January 1995

More Reorganization

A new Center for Nutrition Policy and Promotion has been established under Ellen Haas, under secretary for USDA's Food, Nutrition and Consumer Service (FNCS) with Eileen Kennedy serving as executive director.

To help staff this center, the Agricultural Research Service has transferred to FNCS its family economics and nutrition education research groups. The center will serve as the focal point in USDA for coordinating nutrition policy issues, including publication of the Dietary Guidelines for Americans and the Food Guide Pyramid, as well as nutrition promotion activities.

ARS retains the programs responsible for compiling the nutrient databases of foods and for conducting nationwide food consumption surveys. These two units have been incorporated into ARS' Beltsville Human Nutrition Research Center.

Weight Training Works Out Woes of Aging

Grandmother-age women may soon be flocking to the gym to strengthen thigh and torso muscles and thus prevent osteoporosis and related fractures. A year-long study of women aged 50 to 70 shows that strength training can preserve bone density and prevent losses in muscle strength, balance and physical activity. Such losses lead to falls--the greatest risk factor for fractures in the elderly.

Twenty of the 39 volunteers strengthened muscles in the abdomen, the upper and lower back, the front and back of thighs and the buttocks on pneumatic equipment for just 40 minutes twice a week. The resistance was set at 80 percent of the maximum load each could handle at a given session. Meanwhile, a control group of 19 women continued their normal lifestyle.

At the end of the year, the trained group had gained 1 percent more bone density in the hip and spine compared to a 2.5 percent loss in the control group. They also increased strength in the trained muscles from about 35 to 76 percent above the control group. Their balance improved 14 percent. And their spontaneous physical activity--excluding the training sessions--increased by an average 27 percent, whereas it decreased in the control group by nearly as much. The researchers are now testing the effectiveness of comparable exercises they developed that can be done at

home with simple, low-cost leg weights and dumbbells. For more information, contact Miriam E. Nelson, (617) 556-3094, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.

Contrary to common belief, a high-intensity strength training program can be an effective way for older people to maintain their weight while eating more. And it can reduce body fat, according to a study of 12 men and women in their late fifties, sixties and seventies. The volunteers lived at the USDA center during the 3-month study so researchers could account for all of the calories they consumed as well as measure how many calories they burned. Three times a week, the volunteers exercised muscles in the upper leg, upper torso and arms at 80 percent of the maximum weight each could lift at a given session.

After 12 weeks, they were eating an average 15 percent more calories just to maintain their starting weight, while losing an average 4 pounds of body fat. One-third of those extra calories was burned during the resistance exercises themselves. Another one-third was needed to fuel an increase in the people's resting metabolic rate--the energy needed to keep the leaner body functioning while at rest. The research demonstrates the benefits of resistance training in helping older people balance calories burned with calories consumed, while losing body fat and maintaining strength for daily activities. For more information, contact Wayne W. Campbell, (814) 865-3453, now at the Noll Physiological Research Center, Pennsylvania State University, University Park, PA.

The Long and Short of Calorie Restriction

Slashing the number of calories rats consume throughout life is proving to avert age-related loss of brain function. It's well known that life-long calorie restriction--the laboratory equivalent of the ancient practice of fasting--dramatically prolongs life in laboratory animals. In this study, the brain cells of inactive old rats responded to specific chemical signals like those of young rats when they were served only 63 percent of the calories they normally would have eaten.

The receptors for these chemicals, called muscarinic receptors, generally decline in midlife. This leads to a loss of memory and of some motor functions dependent on these

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receptors. But in the calorie-restricted rats, the receptors functioned 25 percent better than in the controls rats that got all the food they wanted. The finding is in line with studies showing that calorie restriction throughout life spares dopamine receptors, which control movement and decline dramatically with aging. *For more information, contact James A. Joseph, (617) 556-3178, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

On the other hand, slashing the calorie intake of middle-aged rats did not prolong life--dampening the hope that people might develop fewer cancers and other diseases of aging by limiting calorie intake after age 50. That finding is in sharp contrast to the results of hundreds of studies done over several decades that restricted animals' calorie intake from youth. Rats lived 30 to 40 percent longer when their calorie intake was two-thirds or less of what they would normally eat. Nutrition researchers theorize that lifelong calorie restriction cuts the number of tumors--the primary cause of death in test rats--by lowering the rate of cell growth. Also, fewer calories may reduce kidney disease.

In the new study, however, male rats ate as much as they wanted for their first 18 months--equivalent to the first 50 years for a man. Then they got 33 percent less food for the rest of their lives, with little or no effect on lifespan. Apparently, certain disease processes have already begun by middle age, too late to be helped by calorie cutting. *For more information, contact Ruth D. Lipman, (617) 556-3204, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Of Appetite Regulation and Yo-Yo Dieting

As people age, they lose the automatic ability to regulate appetite and so maintain a constant weight, according to a study of both young and older men. The findings help explain why people tend to gain weight during middle age--which is a major national health problem--then progressively lose weight and lean body mass after age 65. This contributes to malnutrition so common in the oldest.

In the study, 9 older men kept on the extra pounds gained during 3 weeks of eating about 1,000 calories more than their normal intake each day. Ten young men, however, automatically ate less and dropped back to their normal weight over the following 6 weeks. In fact, much of their weight loss occurred during the first 10 days after overeating, even though all volunteers were instructed to eat normally and not try to lose weight.

Older men don't bounce back from undereating, either. After 3 weeks of eating about 800 calories daily less than usual, they didn't automatically increase their intake. But the young men gained back more than they lost in the 6-week follow-up despite the request to eat normally. The findings are the first direct evidence of an age-related loss of

appetite control. *For more information, contact Susan Roberts, (617) 556-3237, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Slim and trim adult rats that were put on a yo-yo diet had 3 to 4 percent more body fat than control animals kept on a steady calorie intake. These findings suggest that weight cycling--gaining, losing and regaining--could tip the scale in favor of fat accumulation in the body, at least for a while. Animals and people appear to adapt to a reduction in calories by storing more fat in times of plenty to prepare for the next deficit. A 3- to 4-percent increase in fat is not much for people of normal weight. But it can be quite significant for obese people, who often have much larger weight swings than the study rats.

Because rats normally keep growing throughout life if allowed to eat all they want, the researchers limited growth of the test animals prior to the study so it would more nearly approximate that of adult humans. Then they put 1 group of rats through 3 weight cycles in which they gained 10 percent above starting weight, lost 10 percent below, then returned to starting weight. The other group remained on the growth-restricting diet. Both groups had the same energy intake and expenditure at the end of each cycle. *For more information, contact Paul W. Moe, (301) 504-8988, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Dietary Copper Shortage Linked to Aging

Copper deficiency in test animals causes symptoms that resemble those of human diabetes and aging, and new findings shed light on why. They support the hypothesis that copper deficiency increases the spontaneous attachment of glucose molecules to proteins, a process known as protein glycation. Left unchecked, the dangling glucose molecules attach to a second site on the protein, producing "cross links." This prevents proteins from functioning because they can't change shape to fit into specific receptor sites like puzzle pieces fit into only one spot. Protein glycation is known to increase in all people as they age and to cause tissue damage in diabetics.

To test the hypothesis that copper deficiency promotes the process, an ARS researcher administered daily doses of the drug aminoguanidine to half of a group of copper-deficient rats. The drug does not block the initial attachment of glucose but prevents the formation of cross links. At the end of the study, treated rats had less of the anemia and heart damage characteristic of copper deficiency, whereas untreated rats died prematurely from these conditions. *For more information, contact Jack T. Saari, (701) 795-8499, Grand Forks Human Nutrition Research Center, Grand Forks, ND.*

Getting Premies Off to a Head Start

Very low-birth-weight infants taking mother's milk through a tube in their stomachs gain weight faster when given only the portion of the milk produced 2 to 3 minutes after the flow begins. That's according to a study of 15 preemies ranging from a little more than 1 pound to nearly 5 pounds at birth.

This hindmilk, as it is called, is richer in fat than the initial flow and offers a concentrated source of calories. As a result, the preemies gained an average 1/4 ounce more each day than when fed regular breastmilk. That weight is closer to what they would have gained had they still been in the uterus.

Very low-birth-weight infants often have difficulty gaining weight on breastmilk and are switched to formula. But they lose the substances in breastmilk that appear to protect them against potentially life-threatening infections. So researchers are looking for ways to approximate fetal development with mother's milk. *For more information, contact Richard J. Schanler, (713) 798-7000, Children's Nutrition Research Center, Houston, TX, or Christina J. Valentine, (713) 770-1380, Baylor College of Medicine, Houston, TX.*

Several large feedings rather than a continuous feeding may promote more natural maturation of the intestinal tracts of very premature infants and full-term babies who need to be fed through a tube for extended periods. A preliminary study of piglets found that the group that got four "milk meals" through a tube into the stomach had significantly more intestinal growth and greater amounts of some digestive enzymes than those fed continuously.

Piglets were tested because their digestive system closely resembles that of humans. Researchers were looking for ways to encourage the intestinal tract to develop as naturally as possible in situations like tube feeding. Normally, the small intestine undergoes dramatic growth and development of its digestive capability after birth, particularly in preterm infants. And the enzyme that digests the primary milk sugar, lactose, increases the most during the last trimester of pregnancy.

Researchers are now testing these 2 feeding regimens in 80 low-birth-weight infants and, at the same time, determining the optimal time to begin feeding--3 to 4 days after birth versus 7 to 10 days. *For more information, contact Robert Shulman, (713) 798-7145, Children's Nutrition Research Center, Houston, TX.*

Fat-Soluble Vitamins Don't Compete

Do supplements of fat-soluble vitamins compete with one another in the intestinal tract for absorption, as some reports suggest? No, according to studies using ferrets as a model. In fact, researchers found that a dose of vitamin E equivalent to the Recommended Dietary Allowance (RDA)

for humans actually enhanced beta carotene uptake fourfold. Raising the vitamin E dose to 20 times the RDA increased beta carotene uptake fourteenfold to nineteenfold. Vitamin E also increased the conversion of beta carotene into vitamin A in line with the amount of vitamin E taken.

A dose of beta carotene, on the other hand, didn't enhance vitamin E uptake. But it didn't block it either. If people respond as the ferrets did, vitamin E supplements may be used to improve beta carotene and vitamin A status when ingested with beta carotene. Both nutrients are important antioxidants. Vitamin E supplements have been associated with a lower rate of heart disease. And a high beta carotene intake has been linked to reduced risk of several cancers. *For more information, contact Xiang-Dong Wang, (617) 556-3130, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Microbes Take the Bite Out of Mosquitos

A microscopic organism that attacks disease-carrying mosquitoes is being tested in Florida field studies. They're the first outdoor tests in the United States of a foreign microorganism to control *Aedes aegypti* mosquitoes, which spread yellow fever and dengue. These viral diseases are not currently found in the United States but have the potential to spread here from other parts of the world. A microsporidium, *Edhazardia aedis*, infects the mosquitoes with tiny spores that eventually weaken or kill the insect. Female mosquitoes that survive spread the microsporidium to the next generation through their eggs.

In lab tests, *E. aedis* has had no long-term, adverse effects on animals or beneficial insects such as honey bees. The mosquito has developed resistance to insecticides. And the current control method of removing standing-water in which the pest breeds often isn't practical. If the biocontrol field tests are successful over the next few years, the microsporidium could be developed commercially as a natural way to control *A. aegypti* mosquitos. *For more information, contact James J. Becnel, (904) 374-5961, Medical and Veterinary Entomology Research Lab, Gainesville, FL.*

NESSy To Get Miniaturized for Surveys

ARS has enlisted Monarch Foundation for Medical Research in Cincinnati to further simplify a computerized system for monitoring what people eat. Nutritionists translate these data into nutrient intakes to determine what nutrients need to be emphasized in educational and feeding programs. ARS scientists developed the Nutrition Evaluation Scale System (NESSy) several years ago. Today, volunteers in nutrition studies enter data into NESSy at home on a notebook computer, which is linked to a food-weighing scale to accurately log the foods that are eaten.

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Researchers now want to downsize NESSy to run on a smaller computer, perhaps palm-sized, so volunteers can more conveniently take the program to work or even to a restaurant. NESSy is cheaper, more accurate and more efficient than the traditional approach to at-home food monitoring, in which volunteers are supposed to keep a handwritten record or daily food diary. A simplified NESSy eventually might be used in the national food consumption surveys. *For more information, contact Mary J. Kretsch, (415) 556-6225, Western Human Nutrition Research Center, San Francisco, CA.*

Rice Bread for Wheat Allergy Sufferers

An ARS recipe using rice flour for making bread has been newly adapted to home bread-baking machines. ARS scientists developed a recipe some 20 years ago for people with celiac disease, a wheat allergy. Now a researcher has revised the recipe to give the home baker a new choice among rice breads they can make with the countertop appliance. The machine automatically mixes, kneads and bakes the rice-flour dough, but must be assisted after the kneading cycle. The recipe calls for methyl cellulose, a food processing ingredient. Methyl cellulose traps bubbles given off by yeast, making the dough rise and giving the bread its light texture. The recipe also requires short- or medium-grain white or brown rice, sold at health food stores and Asian grocery markets. Home bakers can modify the flavor by substituting honey or brown sugar for table sugar, or by adding small amounts of spices, fruits or nuts. The recipe was developed by Maura Bean at the ARS Western Regional Research Center in Albany, CA. *For copies of the recipe, write to Marcia Wood, USDA-ARS Information Staff, 800 Buchanan Street, Room 3014, Albany, CA 94710.*

A-MAY-zing Grapes

Black Emerald, a new seedless grape, is ready to harvest in mid-May when no other top-quality, U.S.-grown, black seedless grape is on the market. ARS researchers made Black Emerald available to growers this spring after 7 years

of tests. In the next 3 to 5 years, growers may plant enough vines to market the grapes nationally. Black Emerald's sweet, juicy grapes are about the size of a dime. The flesh is translucent and firm--almost crisp. Growers funded part of the research through the California Table Grape Commission. *For more information, contact David W. Ramming or Ronald Tarailo, (209) 453-3160, Horticultural Crops Research Laboratory, Fresno, CA.*

Pest Control Au Natural

Insect pathogens are the latest weapons against the citrus leafminer, a new pest eating its way through Florida's citrus groves. Leafminers, which appeared in May 1993, have spread rapidly throughout Florida and have become a threat to citrus groves and nurseries. Among the environmentally friendly pathogens deployed against the leafminer: *Paecilomyces* fungi, *Bacillus thuringiensis* bacteria, a nuclear polyhedrosis virus and *Steinernema carpocapsae* nematodes. The pathogens being used won't attack any beneficial insects and will harm only their target pest. *For more information, contact Jeffrey P. Shapiro or William J. Schroeder, (407) 897-7300, U.S. Horticultural Research Laboratory, Orlando, FL.*

A little too much of the female moth's perfume is part of a three-pronged approach for controlling diamondback moths and other crop pests without using chemicals. Diamondback moths are the most destructive insect pests of broccoli, cauliflower, cabbage and other cruciferous vegetables worldwide. Normally, male moths welcome the female's sex scent, called a pheromone. That chemical scent helps the males find females ready to mate.

To interrupt reproduction, ARS scientists are flooding crop fields in Florida with the synthetic female pheromone. Males become confused, unable to pick up a female's scent. In field tests, only 36 percent of female moths had mated in scent-laden fields, compared to 86 percent in conventional fields. That meant pesticide sprayings were reduced from 15 to three on the fields where pheromones were used. Other control tactics include parasitic wasps that attack moth larvae, and Bt insecticide that kills surviving larvae without damaging the beneficial wasps. *For more information, contact Everett Mitchell, (904) 374-5710, Insect Attractants, Behavior and Basic Biology Research Lab, Gainesville, FL.*

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